Trac

DIRECTORATE FOR QUALITY AND STANDARDS IN EDUCATION
Department for Curriculum Management and eLearning
Educational Assessment Unit

Annual Examinations for Secondary Schools 2013

FORM 5 **PHYSICS** **TIME: 2 hours**

Name: _______________________________________ **Class: _______________**

Answer ALL questions in the spaces provided on the Examination Paper.
All working must be shown. The use of a calculator is allowed.
Where necessary take the acceleration due to gravity g = 10 m/s^2.

Density	$m = \rho V$	
Pressure	$P = h \rho g$	$P = F/A$
Moment	Moment = F x perpendicular distance	
Energy	$PE = m g h$ $E = P t$	$KE = ½ m v^2$ Work Done = F s
Force	$F = m a$	$W = m g$
Motion	Average speed $= \frac{\text{total distance}}{\text{total time}}$ Momentum = m v	$v = u + at$ $s = ut + ½ at^2$ $v^2 = u^2 + 2as$ $s = \frac{(u+v)t}{2}$
Electricity	$Q = I t$ $V = I R$ $P = I V$ $E = I V t$	$E = Q V$ $R_T = R_1 + R_2 + R_3$ $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$
Electromagnetism	$\frac{N_1}{N_2} = \frac{V_1}{V_2}$	
Heat	$Q = m c \Delta\theta$	
Waves	$v = f \lambda$ $f = \frac{1}{T}$ $\eta = \frac{\text{real depth}}{\text{apparent depth}}$	$m = \frac{h_i}{h_o} = \frac{\text{image distance}}{\text{object distance}}$ $\eta = \frac{\text{speed of light in air}}{\text{speed of light in medium}}$
Radioactivity	$A = Z + N$	

Marks Grid: For the Examiners' use ONLY

Question	1	2	3	4	5	6	7	8	9	10	11	12	Th.	Prac	Total	**Final Mark %**
Mark	10	10	10	10	10	10	10	20	20	20	20	20	170	30	200	100
Score																

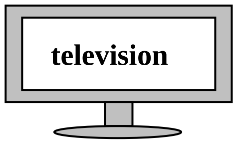
Section A. This section has 7 questions. Each question carries 10 marks.
(Total 70

1. a. Complete the missing words by choosing the **correct** words from the list below:

created, diminished, destroyed, magnified, changed

The principle of conservation of energy states that energy can neither be ______________ nor ______________, but can be ______________ from one form to another. (3)

b. The list below includes various forms of energy:



heat energy, electrical energy, sound energy, wind energy, light energy

Choose from this list **one** form of energy for each of the following:

i. energy input to the television, __________________________ (1)

ii. useful energy output by the screen of the television, __________________________ (1)

iii. useful energy output by the speakers of the television, __________________________ (1)

iv. energy wasted by the television. __________________________ (1)

c. A television set uses 300 W of electrical power to produce 270 W of useful power. Calculate:

i. the power wasted by the television set,

____ (1)

ii. the efficiency of the television set.

____ (2)

2. Matthew has four solid blocks of the same size but of different materials as shown below. The density of the material of each block is given in Table 1 below.

copper **iron** **redwood** **lead**

a. Calculate:

i. the mass of the 20 cm^3 copper block in grams (g),

____ (2)

ii. the mass of the copper block in kilograms (kg),

____ (1)

iii. the weight of the copper block.

(2)

Material	**Density ρ in g/cm^3**
copper	8.9
iron	7.9
redwood	0.5
lead	11.4

Table 1

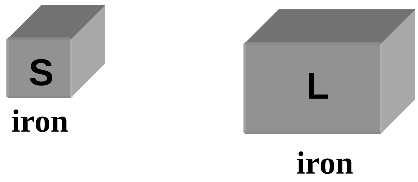
b. The density of water is 1 g/cm^3.

i. Name **one** material from Table 1 which floats on water. ______________________

ii. Give a reason for your answer.

____ (1)

c. Joseph has another iron block, marked L, larger than that of Matthew's, marked S.



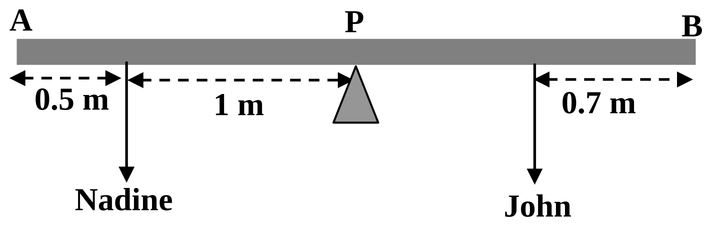
i. Tick (√) one box with the correct answer.
The density of the larger iron block **L** is:

☐ greater than 7.9 g/cm^3 ☐ smaller than 7.9 g/cm^3 ☐ equal to 7.9 g/cm^3 (1)

ii. Give a reason for your answer.

____ (2)

3. The figure below represents Nadine and John sitting on a uniform seesaw AB. The weight of the seesaw is 300 N and the pivot is at the centre of the seesaw. Nadine weighs 400 N.



a. Find:

i. the distance between John and the pivot **P**, ______________________ (2)

ii. the direction of Nadine's turning effect about the pivot **P**. ______________________ (1)

b. On the above figure mark the position of the weight of the seesaw **AB** by means of an arrow. (1)

c. Calculate:

i. the size of Nadine's moment about the pivot,

____ (2)

ii. John's weight assuming that the seesaw is perfectly horizontal (in equilibrium),

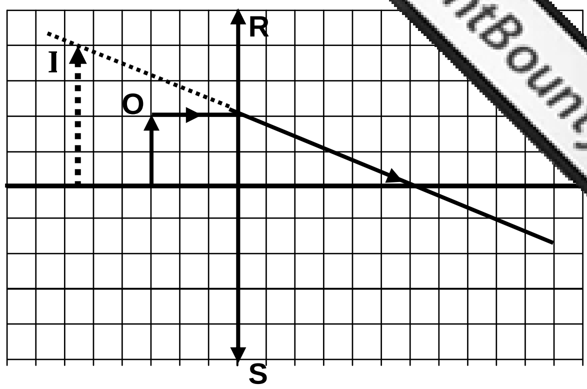
____

____ (2)

iii. the total weight supported by the pivot.

____ (2)

4. a. The figure represents a ray diagram for an object O placed in front of a converging lens RS. A ray of light from the top of the object O is drawn to indicate the position of the image I.



i. Draw another ray of light from the top of the object O to show how the position of the image **I** is formed. (1)

ii. Is the image real or virtual? ________________ (1)

iii. Name one **<u>other</u>** property of the image. ________________ (1)

iv. The ray diagram shows the converging lens RS being used as a ________________ (1)

b. Use the ray diagram (**one square represents 1 cm)** to determine the **<u>approximate</u>**:

i. object distance, u, ________________ (1)

ii. height of the image, h_i, ________________ (1)

iii. magnification of the converging lens RS,

____ (2)

iv. focal length of the lens RS. ________________ (2)

5. The list below includes a set of electrical components that can form part of an electric circuit:
switch, diode, rheostat, light dependent resistor (LDR), thermistor, connecting wire

a. State which component from the above list:

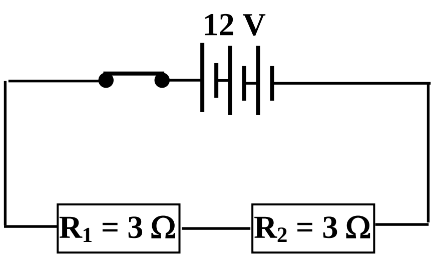
i. is used to allow current to flow in one direction only, ____________________ (1)

ii. causes a break in the circuit, stopping the current flow, ____________________ (1)

iii. has a high resistance at low temperature, ____________________ (1)

iv. has its resistance dependent on the light intensity. ____________________ (1)

b. In the circuit diagram shown, calculate:



i. the total resistance of the circuit,

____ (2)

ii. the total current flowing through the circuit,

____ (2)

iii. the power P of the circuit.

____ (2)

running shoes

6. Ralph, of weight 700 N, jogs every morning wearing running shoes. The area of each foot is $0.25\ m^2$.

a. Calculate:

i. the **<u>total area</u>** of contact with the ground when Ralph stands on both feet,

____ (2)

ii. the pressure exerted by Ralph while standing on both feet.

____ (2)

b. How does the pressure exerted on the ground change when Ralph:

i. stands on one foot? Explain.

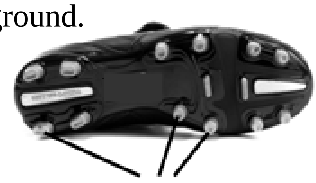
____ (2)

ii. stands on two feet holding a 200 N weight in his hand? Explain.

____ (2)

c. Explain why football shoes studs provide for a better grip with the ground.

____ (2)



football shoes (with studs)

7. A slinky spring fixed at one end is held by Elise at the other end.

Wave A	Wave B

a. Draw in the space above **<u>two</u>** possible types of waves that Elise can produce with the slinky spring. (2)

b. Draw arrows to show how she moves her hands to produce each type of wave. (2)

c. Name each type of wave.

Wave A - ____________________ Wave B - ____________________ (2)

d. Complete the following:

i. Sound waves are ______________ ii. Water waves are ______________ (2)

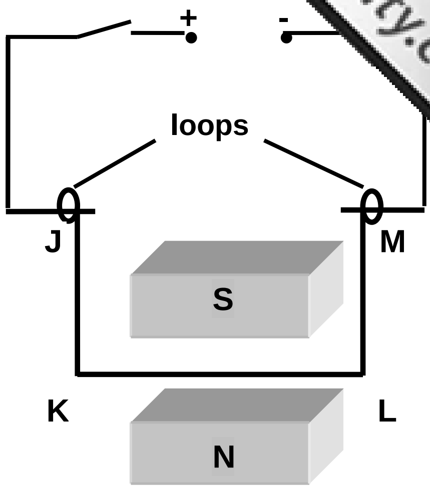
e. Sound waves travel with a speed of 330 m/s and have a wavelength of 2 m. Calculate the frequency of these waves.

____ (2)

Section B. This section has 5 questions. Each question carries 20 marks.

(Total 100

8. ***This question is about the motor effect of an electric current.***



The figure represents a circuit connected to a metal swing JKLM. This metal swing can move freely.

a. On the wire KL, draw an arrow to indicate the direction of the current in the circuit when the switch is closed. (1)

b. Draw **one** line of magnetic flux between the poles of the magnet. (2)

c. State what happens **around** the wire in the circuit when the switch is closed.

____

____ (2)

d. When the switch is closed, the wire KL experiences a force.

i. **Underline** the correct answer:
This force acts (*out of the page towards you / inside the page away from you*). (1)

ii. Name the rule used to determine the direction of the force.

____ (1)

iii. State **two** ways through which the size of this force can be increased.

____ (2)

iv. What will happen if the wire KL is placed parallel to the magnetic field of the magnet?

____ (1)

e. Joe varies the current in the circuit and notes the size of the force as shown in the table below.

Force F / N	0	0.5	1.0	1.5	2.0
Current I / A	0	0.2	0.4	0.6	0.8

i. Plot a graph of the force F (y-axis) against the current I (x-axis). (5)

ii. What is the relationship between the force and the current?

____ (1)

iii. Calculate the gradient of the graph.

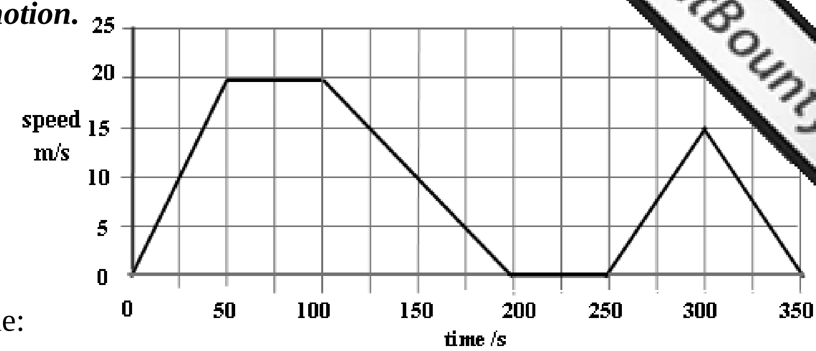
____ (2)

iv. Determine the size of the current required to push the wire with a force of 3 N.

(2)

9. ***This question is about linear motion.***

Kimberly drives her car on a journey. The graph shows how the **speed** of the car changes throughout the whole journey.



a. Use the graph to determine:

i. the **speed** while she drives at constant speed, ____________________ (1)

ii. the **time** that Kimberly stops at the traffic lights, ____________________ (2)

iii. the **acceleration** during the first part of her journey.

____ (3)

b. Kimberly covers 2500 m during the first 200 s of her journey.
Use the graph to calculate:

i. the **distance** covered by Kimberly during the **last** 100 s of her journey,

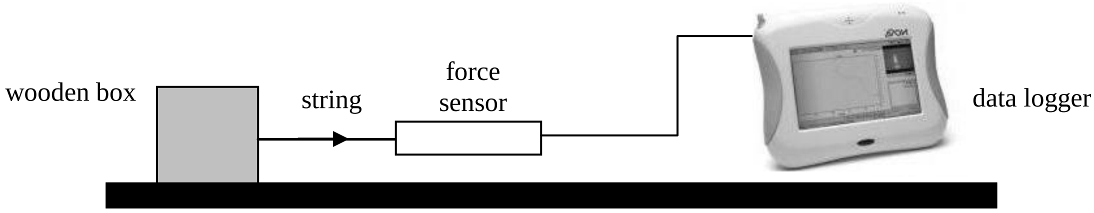
____ (3)

ii. the **total distance** covered during the whole journey, _________________________ (2)

iii. the **average speed** for the whole journey.

____ (2)

c. Andrew investigates whether the **force** required to move a standing object is dependent upon the **mass** of the object. He places a 100 g wooden block on the floor, attaches a string to a force sensor which is connected to a data logger and pulls the box until it starts to move. Andrew is provided with a number of 100 g masses.



i. Describe how Andrew conducts the investigation.

____

____ (2)

ii. Indicate the **two** ways how the results may be presented.

____ (2)

iii. Name **one** variable which Andrew must keep constant during the investigation.

____ (1)

iv. Predict how the force required for moving an object varies with the mass of the object.

____ (2)

10. ***This question is about radioactivity.***

a. Complete the following statements:

i. Proton number **Z** is the number of ___________ in the nucleus of an atom.

ii. Nucleon number **A** is the number of ___________ and ___________ in the nucleus of an atom. (2)

b. Carbon-14 and carbon-12 are isotopes.

i. Explain the term **isotopes**.

____

____ (2)

ii. The proton number of carbon-12 is 6. The symbol for carbon is **C.** Write down the symbol for carbon-12 showing its proton and nucleon number.

____ (2)

c. A detector of radioactivity connected to a counter gives a count even though a radioactive source is not present.

i. This count is due to ______________________ radiation. (1)

ii. Name **two** sources of this radiation.

____ (2)

iii. Name the instruments used to **detect** and **measure** this radiation rate.

____ (2)

d. Paula and Andrea set up the necessary apparatus to find the **half-life** of an unknown radioactive substance **X**. The detector records a count rate of 18 counts per minute when switched on. The count rate increases to 1618 counts per minute when a small sample of **X** is placed closer to the detector-and-counter.

i. What is the count rate due to the radioactive substance **X** only? _______________ (1)

ii. Explain the term **'half-life'**.

____ (2)

iii. After 15 minutes the count rate, due to the radioactive substance only, drops to 200 counts per minute. Calculate its **half-life**.

____ (3)

iv. Give the **total** count rate given by the rate meter after 20 minutes. _______________ (2)

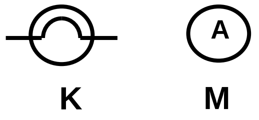
11. ***This question is about Ohm's Law.***

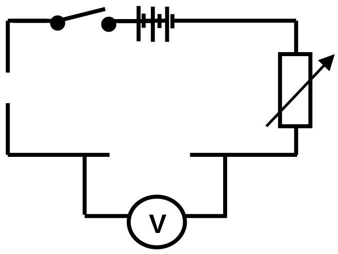
a. **Complete** the following:

Ohm's Law states that ____

____ (3)

b. Malcolm and Simone set up an experiment to investigate whether a **filament lamp** obeys Ohm's law. Electrical components K and M are left out as shown below.





i. **Label** K and M.

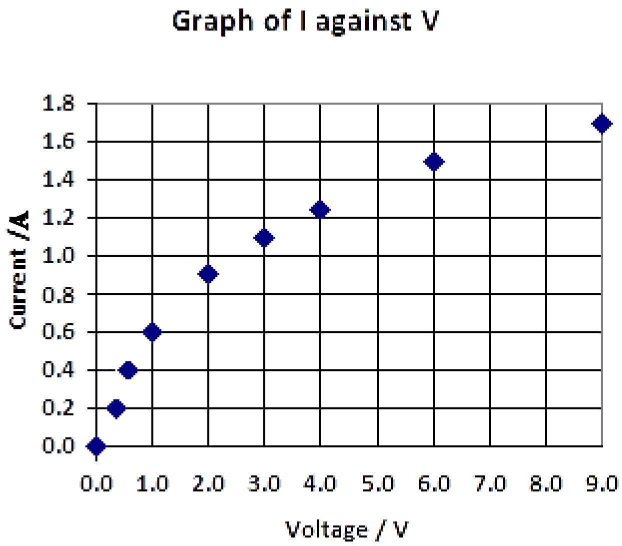
____ (2)

ii. **Draw** the electrical components K and M in their correct positions in the circuit. (2)

iii. How is the variable resistor used in this experiment?

____ (2)

c. Malcolm and Simone plot the points on a graph grid as shown below.



i. Draw the **best smooth curve** through the plotted points on the graph grid. (1)

Use the graph to determine:

ii. the **current** flowing through the filament lamp when the p.d. across it is 5 V, ______ (1)

iii. the **p.d.** across the filament lamp when a current of 1.7 A is flowing through it, _______ (1)

(1)

iv. the **resistance** of the filament lamp at a p.d. of 6 Volts.

____ (2)

v. Does the filament lamp obey Ohm's law? ________________ (1)

vi. Which feature of the graph supports your answer to question c (v)?

____ (2)

d. Malcolm notes that when the p.d. across the filament lamp is set to a **high** lamp turns off.

i. What may happen to the filament of the lamp when a high voltage is applied across

(1)

ii. State what happens to the size of the current flowing through the filament lamp when a high voltage is applied across it.

(1)

iii. What will be the resistance of the filament lamp at this high voltage?

(1)

12. ***This question is about energy.***

Julia and Maurice set up an experiment to find the **specific heat capacity** of orange juice.

a. Explain how Julia and Maurice carry out this investigation. Your answer should include:

i. a **<u>labelled</u>** diagram of the experimental setup (details of electric circuit not required),

(4)

ii. **<u>three</u>** measurements Julia and Maurice need in order to determine the specific heat capacity of orange juice,

(3)

iii. a method to ensure that the heat supplied by the immersion heater is evenly distributed throughout all the orange juice,

(1)

iv. **<u>two</u>** precautions that they need to take during this investigation.

(2)

b. A block of lead of mass 5 kg is dropped from a height of 8 m. Calculate:

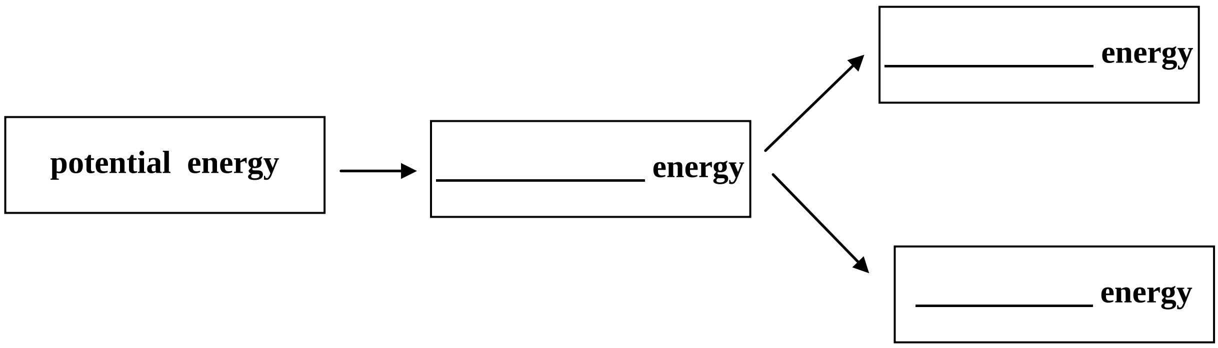
i. the initial **potential energy** of the lead block at the top.

____ (2)

ii. the **kinetic energy** of the lead block just before it touches the ground, assuming no air resistance. Give **one** reason for your answer.

____ (2)

iii. Complete the following energy flow diagram showing the energy changes when the lead block falls through a height of 8 m and hits the ground, assuming no air resistance.



(3)

c. When the lead block of mass 5 kg hits the ground, 300 J of energy are generated in the lead block. Calculate the change in temperature of the lead block given that the specific heat capacity of lead is 130 J/kg ^{o}C.

____

____

____ (3)